

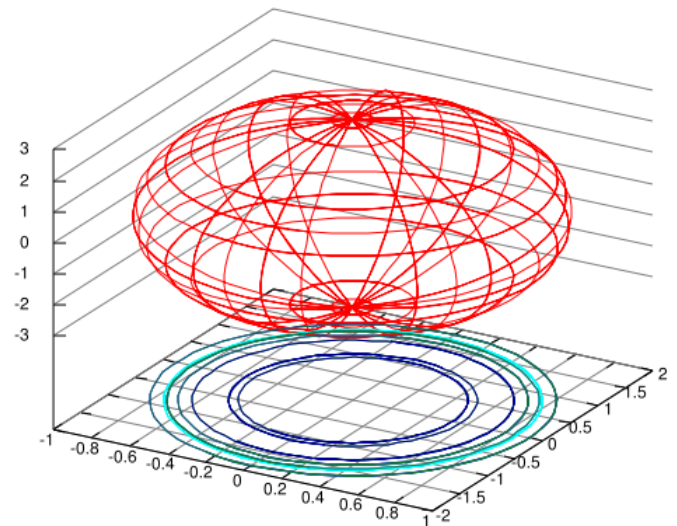
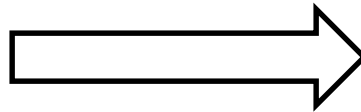
Gnuplot Tutorial

Advanced Systems Lab
Fall 2017

Gnuplot 101

- Gnuplot is a command line tool for generating 2D and 3D plots of your data
- Works on Linux and Windows
- Can be used in interactive or scripted mode

#	x	y	value
0.1	0.3	11	
0.4	-1.1	0.99	
2.3	1.0	0.97	



How to organize your data?

- Output your experimental results as a comma/space/tab separated file

```
# x      value1 value2
0.1     0.3    11
0.4     -1.1   0.99
2.3     1.0    0.97
0.1     -0.1   1.8
```

- You can also include text

```
# category      x      value1 value2
First           0.1     0.3    11
Second          0.4    -1.1   0.99
Third           2.3     1.0    0.97
Fourth          0.1    -0.1   1.8
```

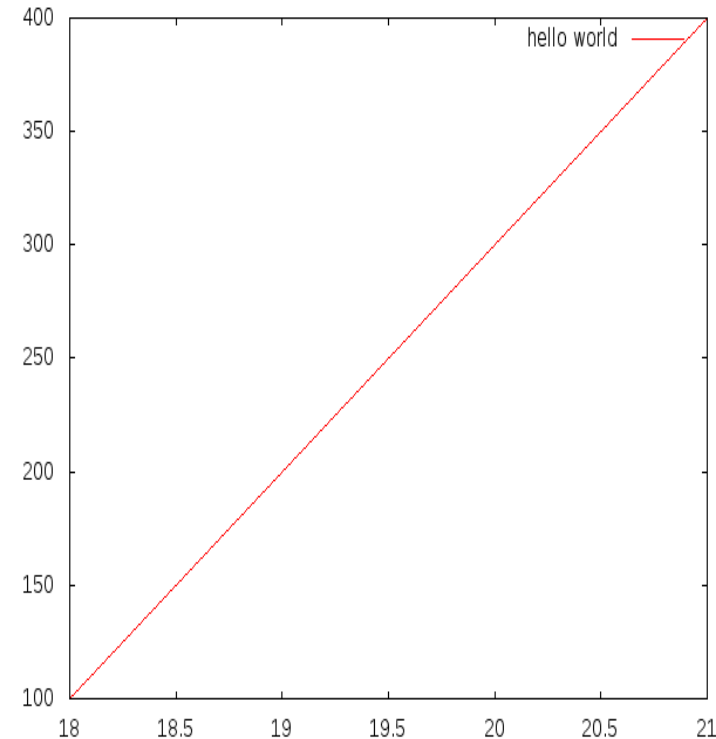
Hello world

- Start Gnuplot and type interactively, or create a text file with commands:

```
      1  2
#  age  income
    18  100
    19  200
    20  300
    21  400
```



```
plot "results.txt" using 1:2 with lines
title "hello world"
```



Gnuplot scripts

- Plots are set up declaratively – see online documentation for all commands

Start with `set term png/pdf/svg` to select the output type

- `set output "filename.png"`
- `set xlabel "x axis label"`
- `set ylabel "y axis label"`
- `plot "filename1" using 1:2 with lines title "first", \`
`"filename2" using 1:3 with linespoints title "second"`

Column values can be combined

- It is possible to plot simple expressions:
 - Plot “file.txt” using 1:(\$2+\$3+\$4) with lines title “summed columns”

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>\$2+\$3+\$4</i>
# t	req_type1	req_type2	req_type3	
1	0	111	0	<i>111</i>
2	2	100	3	<i>105</i>
3	4	120	0	<i>124</i>
4	0	100	22	<i>122</i>
5	3	102	2	<i>107</i>

- You can use other arithmetic operations as well!

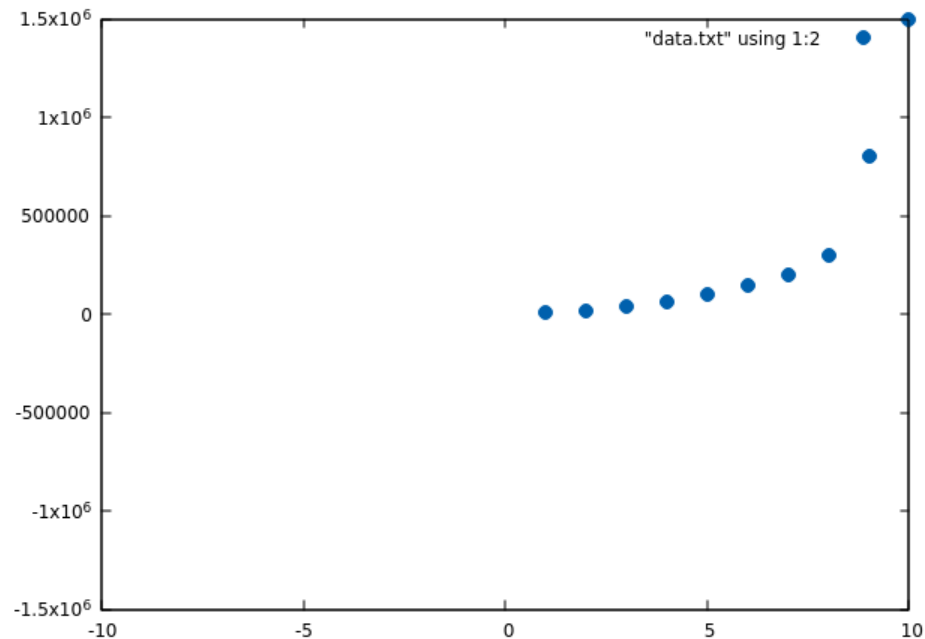
Example: Plotting response time

#	1	2
	CLIENTS	RESPONSE_TIME
	1	10000
	2	20000
	3	40000
	4	60000
	5	100000
	6	150000
	7	200000
	8	300000
	9	800000
	10	1500000

Example: Plotting response time

```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel ""
set ylabel ""
set title ""
set xrange [-10:10]
set yrange [-1500000:1500000]
plot "data.txt" using 1:2 ls 1
```

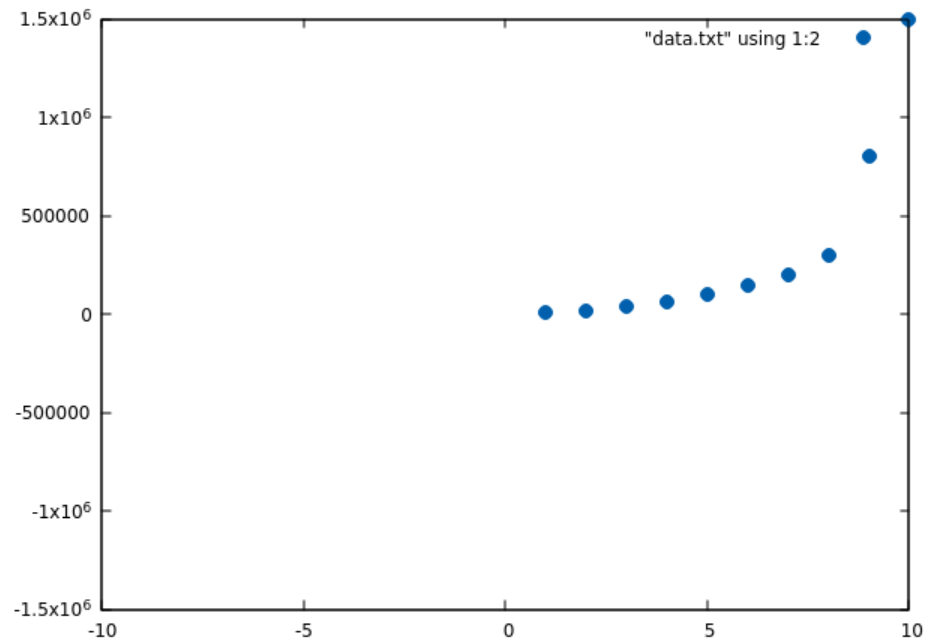
What is wrong here?



Example: Plotting response time

```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel " "
set ylabel " "
set title " "
set xrange [-10:10]
set yrange [-1500000:1500000]
plot "data.txt" using 1:2 ls 1
```

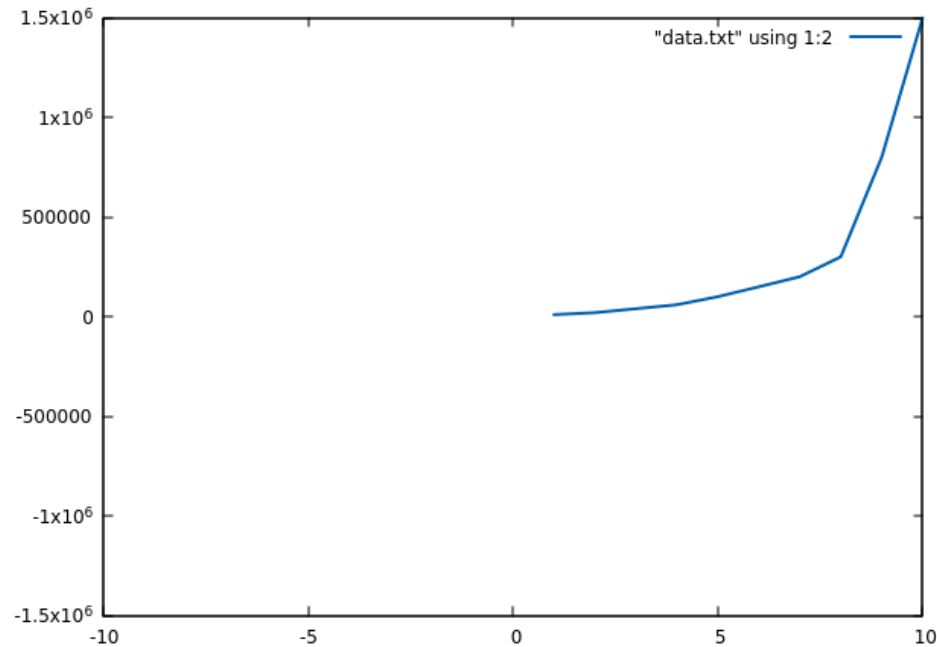
- No labels or title.
- Legend is meaningless.
- Ranges are completely off.
- No lines.



Example: Plotting response time

```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel " "
set ylabel " "
set title " "
set xrange [-10:10]
set yrange [-1500000:1500000]
plot "data.txt" using 1:2 with lines ls 1
```

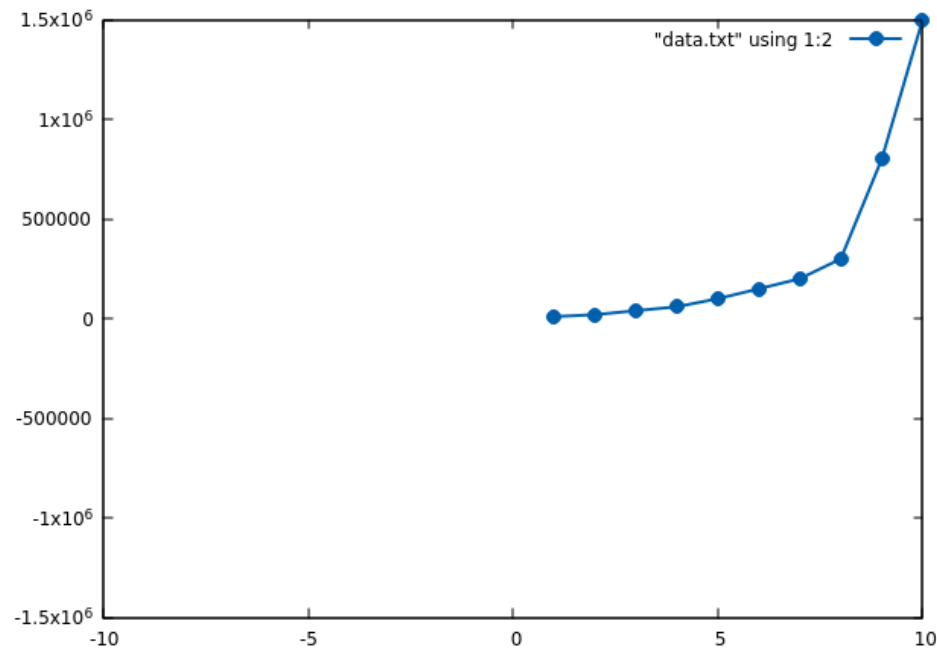
- No labels or title.
- Legend is meaningless.
- Ranges are completely off.
- No ticks.



Example: Plotting response time

```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel " "
set ylabel " "
set title " "
set xrange [-10:10]
set yrange [-1500000:1500000]
plot "data.txt" using 1:2 with linespoints ls 1
```

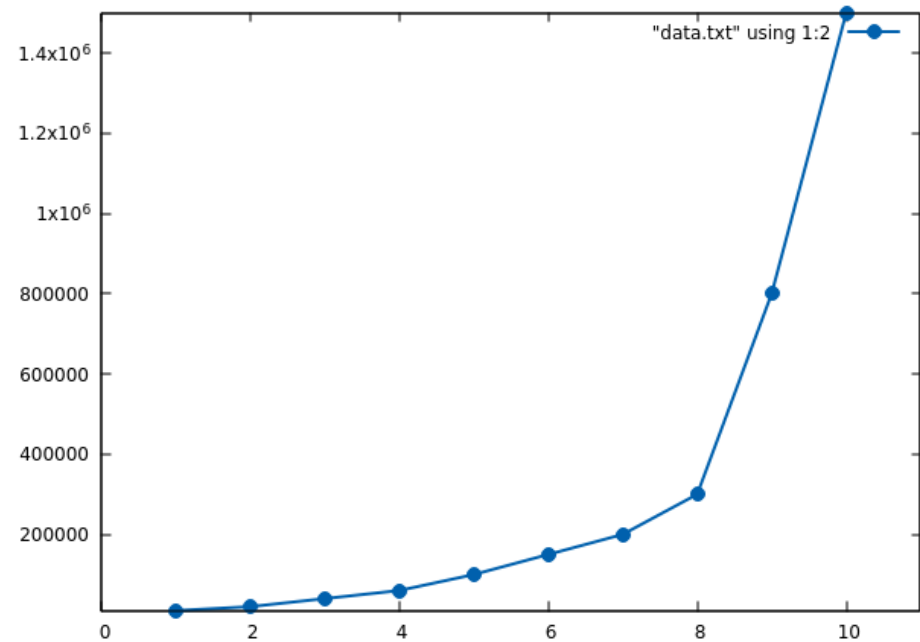
- No labels or title.
- Legend is meaningless.
- Ranges are completely off.



Example: Plotting response time

```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel " "
set ylabel " "
set title " "
set xrange [0:11]
set yrange [10000:1500000]
plot "data.txt" using 1:2 with linespoints ls 1
```

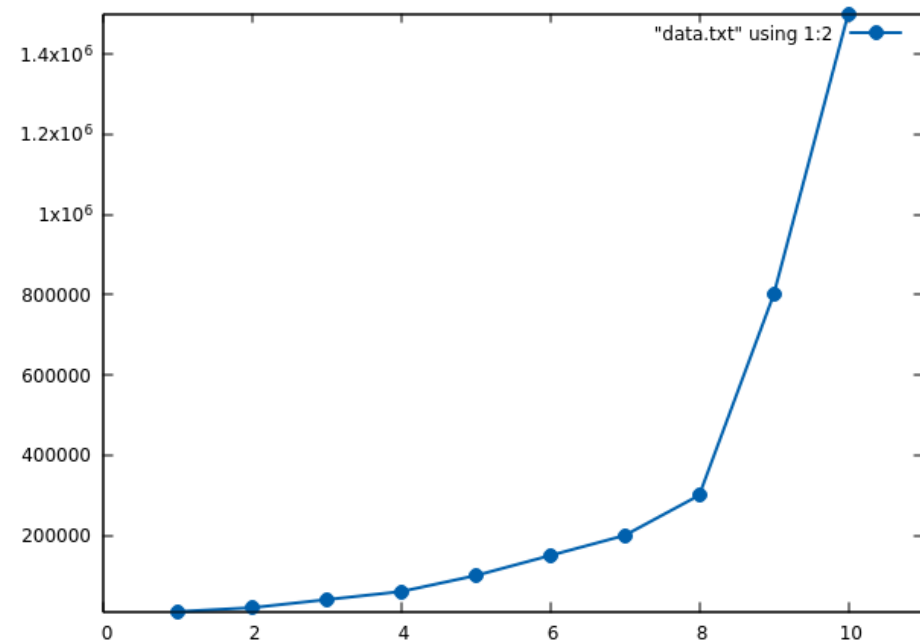
What is wrong here?



Example: Plotting response time

```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel " "
set ylabel " "
set title " "
set xrange [0:11]
set yrange [10000:1500000]
plot "data.txt" using 1:2 with linespoints ls 1
```

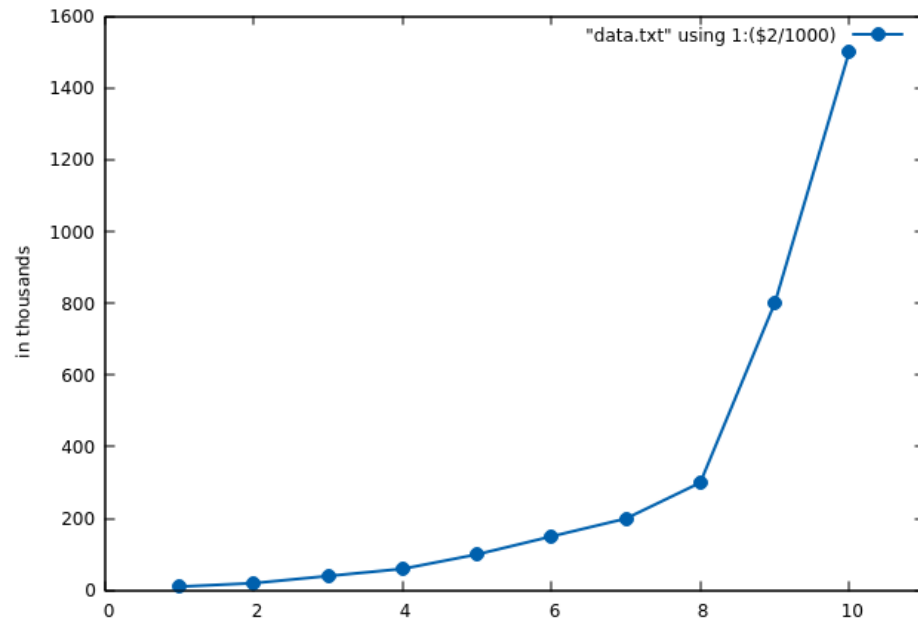
- No labels or title.
- Legend is meaningless.
- y-axis range does not start from 0.



Example: Plotting response time

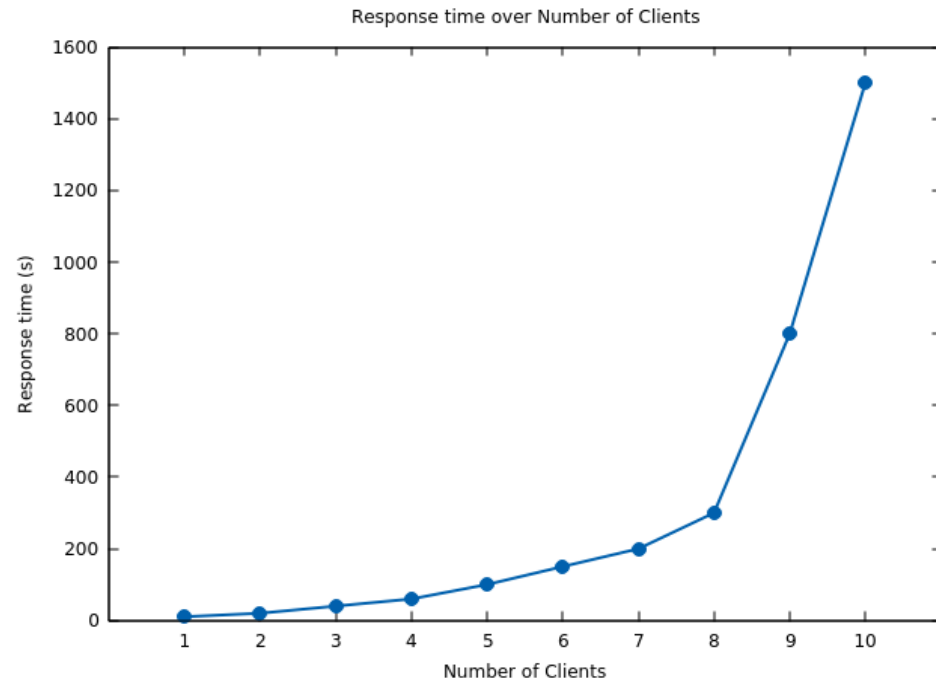
```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel ""
set ylabel " in thousands "
set title ""
set xrange [0:11]
set yrange [0:1600]
plot "data.txt" using 1:($2/1000) with linespoints ls 1
```

- No labels or title.
- Legend is meaningless.
- x-axis ticks are not correct



Example: Plotting response time

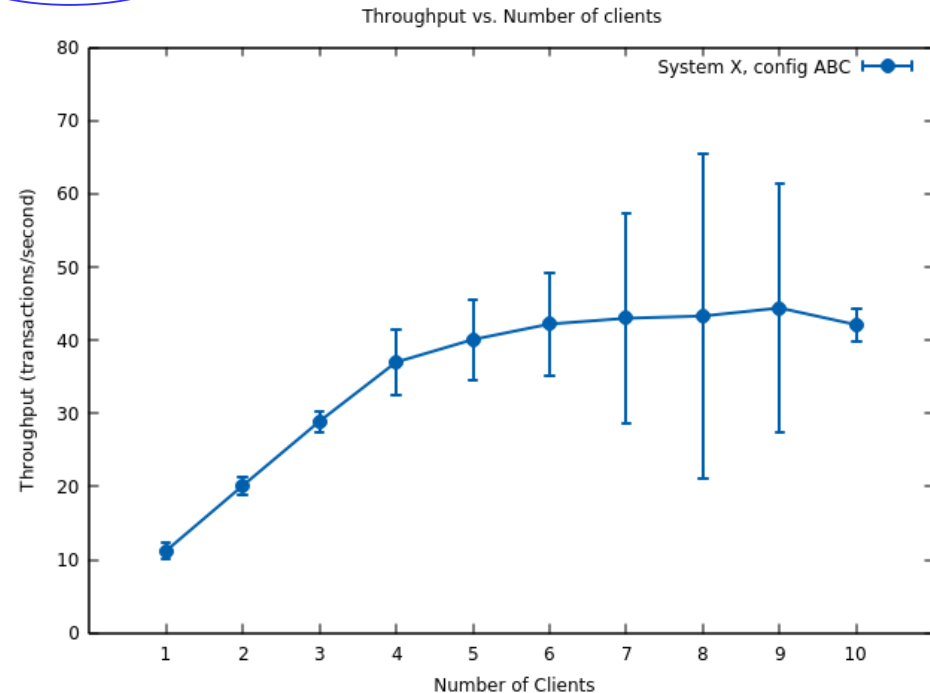
```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel "Number of Clients"
set ylabel "Response time (s)"
set title "Response time over Number of Clients"
set xrange [0:11]
set yrange [0:1600]
plot "data.txt" using 1:($2/1000):xticlabel(1) with linespoints ls 1 notitle
```



Example: Plotting Error Bars

```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5 # --- blue
set xlabel " Number of Clients"
set ylabel " Throughput (transactions/second)"
set title " Throughput vs. Number of clients"
set xrange [0:11]
set yrange [0:80]
plot "data.txt" using 1:2:3:xticlabel(1) with errorlines title "System X, config ABC" ls 1
```

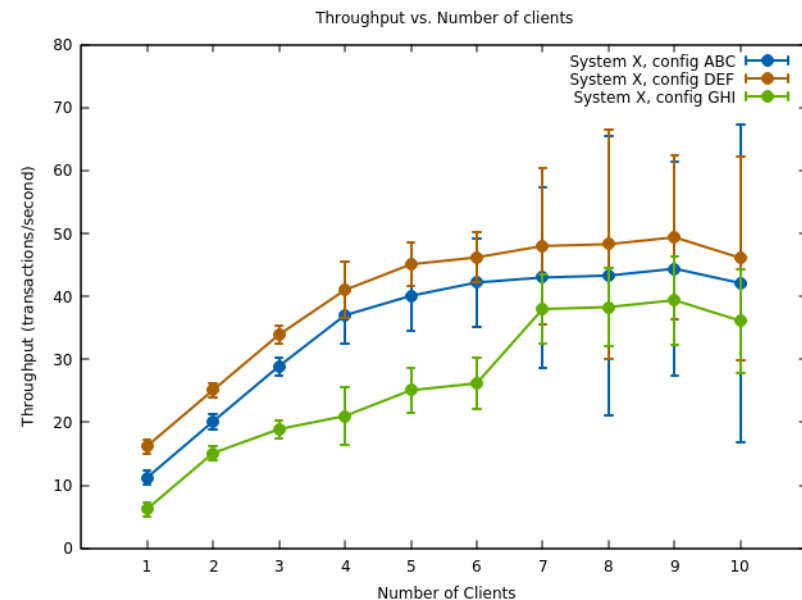
# CLIENTS	THROUGHPUT	STDDEV
1	11.2	1.1
2	20.1	1.2
3	28.9	1.4
4	37.0	4.5
5	40.1	5.5
6	42.2	7.0
7	43.0	14.4
8	43.3	22.2
9	44.4	17.0
10	42.1	2.2



Example: Plotting Multi Lines

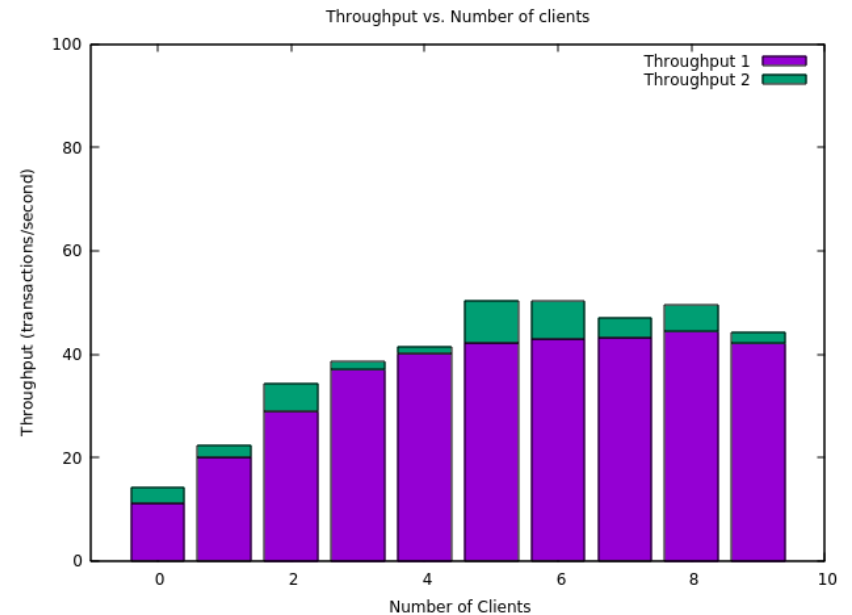
```
set style line 1 lc rgb '#0060ad' lt 1 lw 2 pt 7 ps 1.5
set style line 2 lc rgb '#ad6000' lt 1 lw 2 pt 7 ps 1.5
set style line 3 lc rgb '#60ad00' lt 1 lw 2 pt 7 ps 1.5
set xlabel " Number of Clients"
set ylabel " Throughput (transactions/second)"
set title " Throughput vs. Number of clients"
set xrange [0:11]
set yrange [0:80]
plot "data.txt" index 00:00 using 1:2:3:xticlabel(1) with errorlines title "System X, config ABC" ls 1,
"data.txt" index 01:01 using 1:2:3:xticlabel(1) with errorlines title "System X, config DEF" ls 2,
"data.txt" index 02:02 using 1:2:3:xticlabel(1) with errorlines title "System X, config GHI" ls 3
```

Legends are important in multi-line graphs.



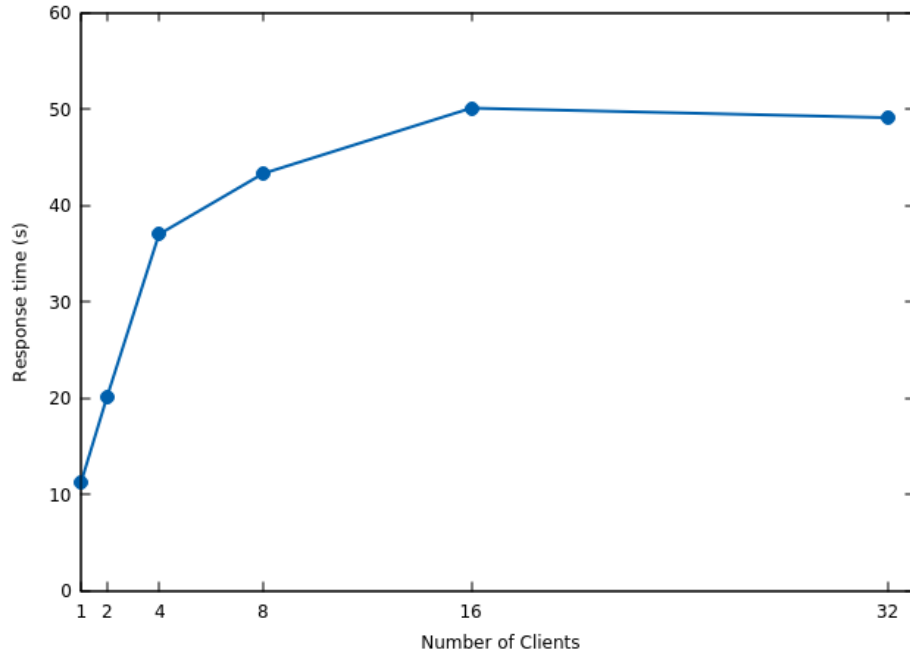
Example: Plotting Stacked Bar Charts

```
set style data histogram
set style histogram rowstacked
set style fill solid 1.0 border -1
set boxwidth 0.8 relative
set xlabel " Number of Clients"
set ylabel " Throughput (transactions/second)"
set title " Throughput vs. Number of clients"
set xrange [-1:10]
set yrange [0:100]
plot "$DATA_FILE" using 2 title "Throughput 1", " using 3 title "Throughput 2"
```

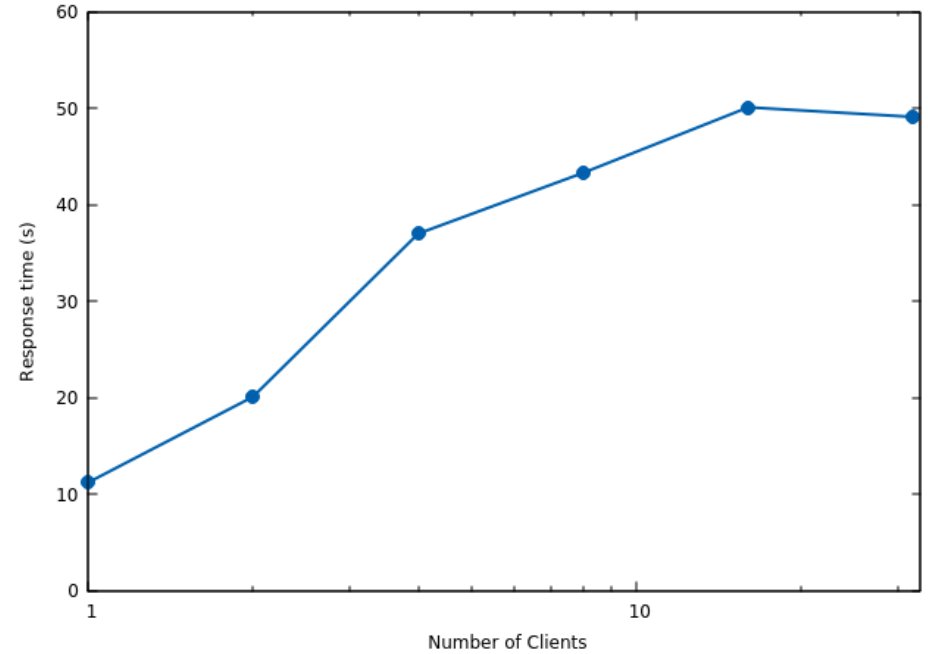


Linear vs. Log Scale

Response time over Number of Clients



Response time over Number of Clients



Recommendations

- As you progress and rerun experiments save results in different files – you can regenerate graphs for different versions of the result
- Keep style consistent over graphs
- Use bash scripts for exporting graphs!

Alternatives

- Bash (GNUplot), Python (matplotlib),
Windows (Excel), Latex (pgfplots) ...
- No hand-drawn graphs!